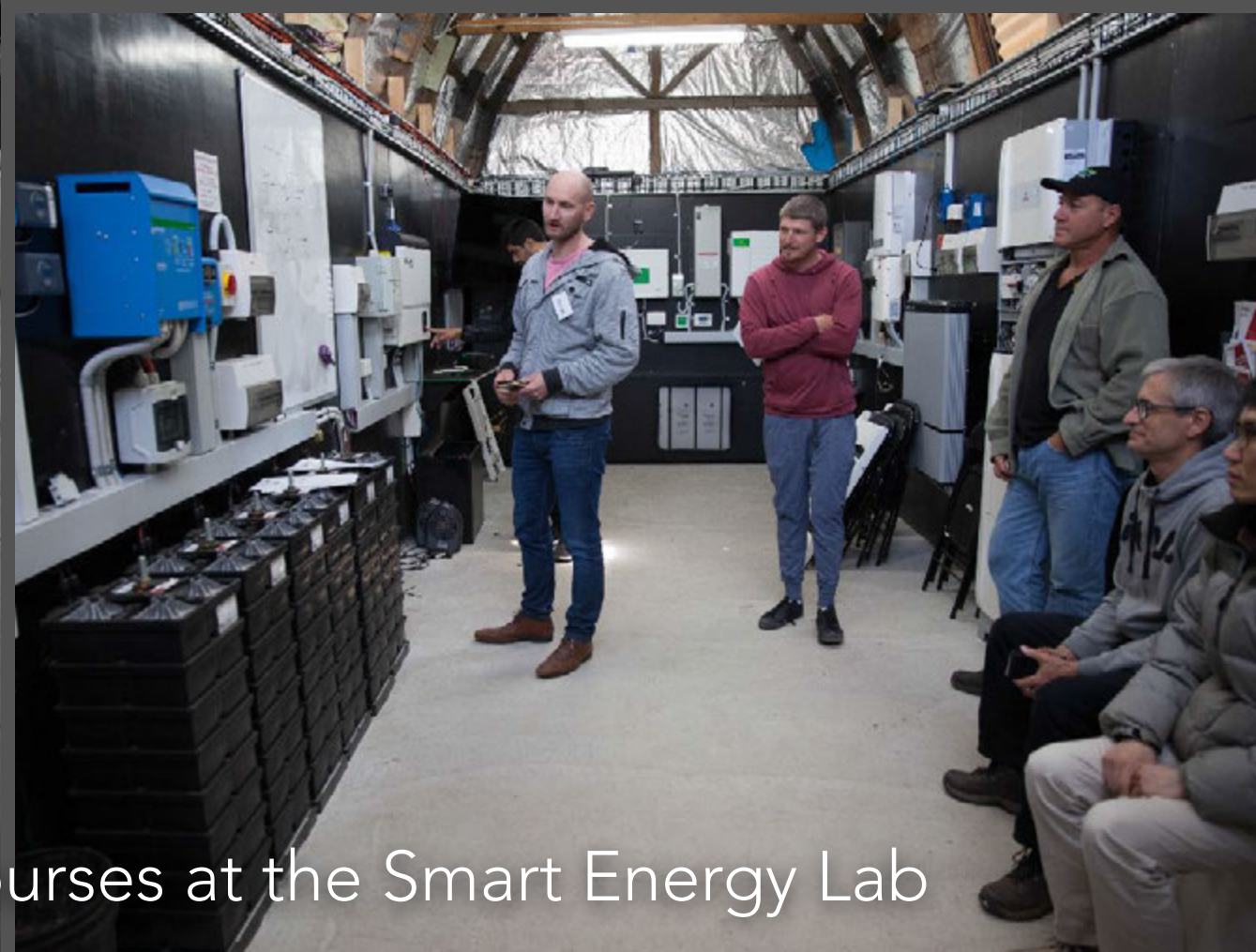


# SOLAR POWER & BATTERIES

GLEN MORRIS - SMART ENERGY LAB







Solar & Storage training courses at the Smart Energy Lab



# WHY DO YOU WANT SOLAR POWER/BATTERIES?

- to save money
- to use more clean energy
- to be more self-reliant

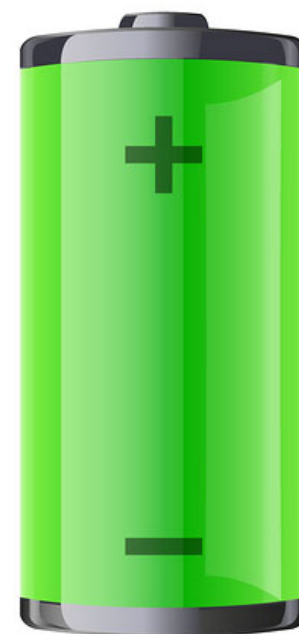
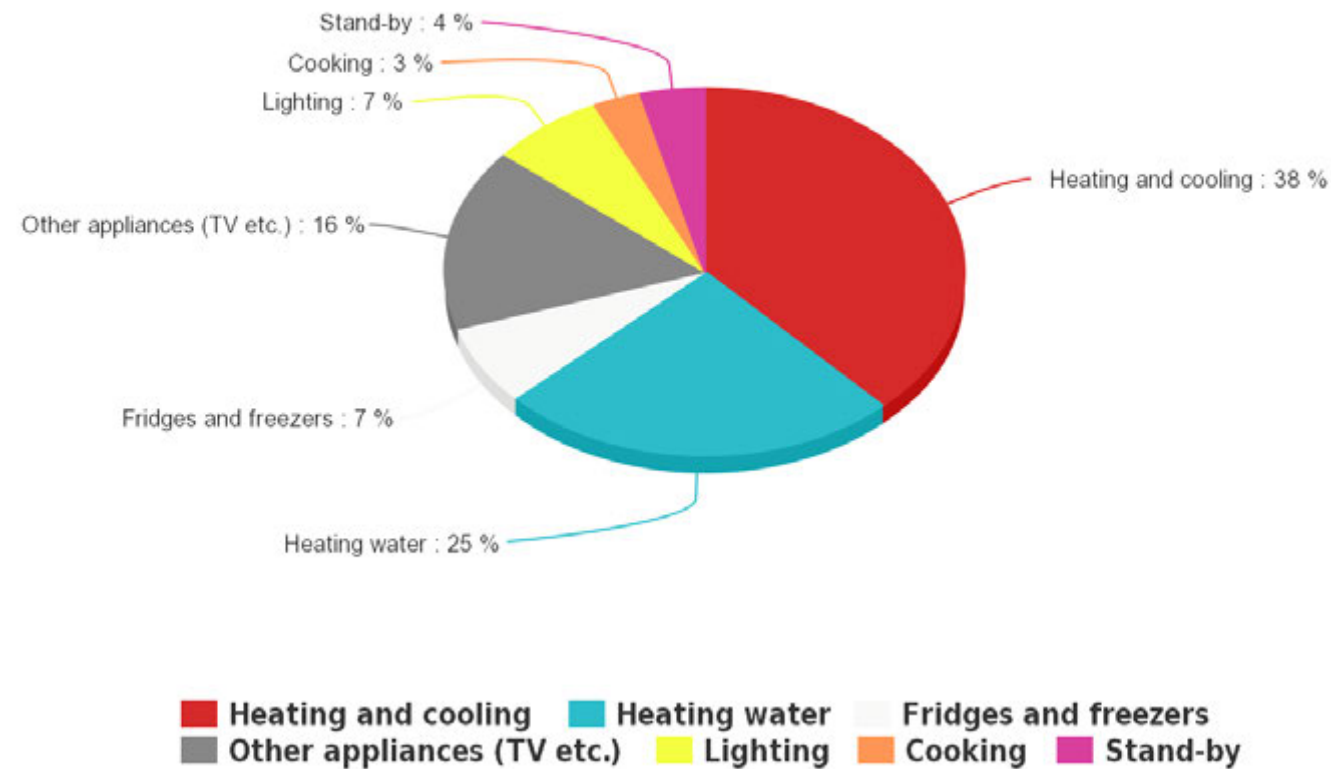


# HOW TO REDUCE ELECTRICITY COSTS

- re-negotiate your electricity contract  
<http://compare.switchon.vic.gov.au/>
- use energy efficient appliances  
<http://energyrating.gov.au/>
- reduce energy use in your home/business
- install solar PV panels and/or solar hot water/heat pump
- install battery storage (long payback)

# BATTERY VS HOT WATER TANK

- most hot water services deliver 6-14kWh/day of energy to the home
- similar sized battery would cost \$5,000-\$10,000 installed
- will need “solar capture” system to store energy in tank



vs.





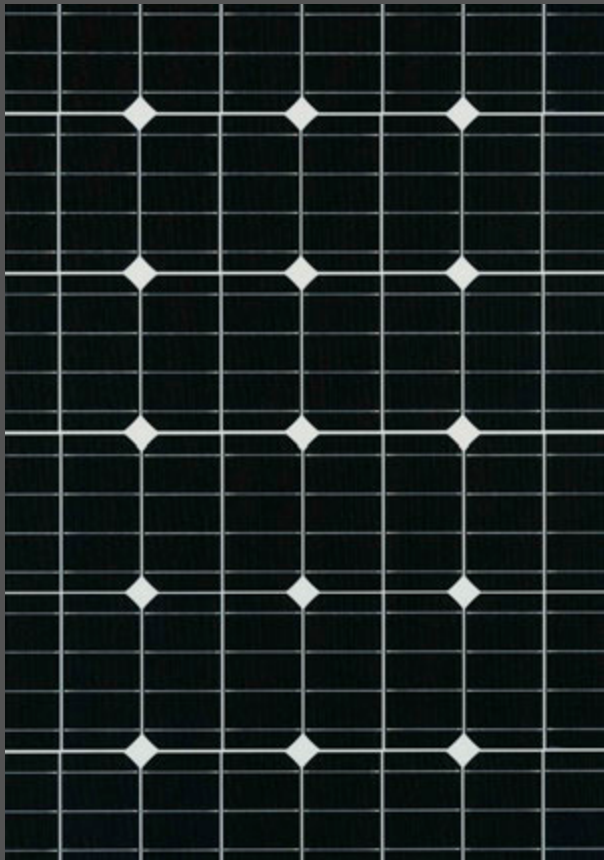
# SOLAR PV PANELS

- size
- power
- quality
- cost
- location





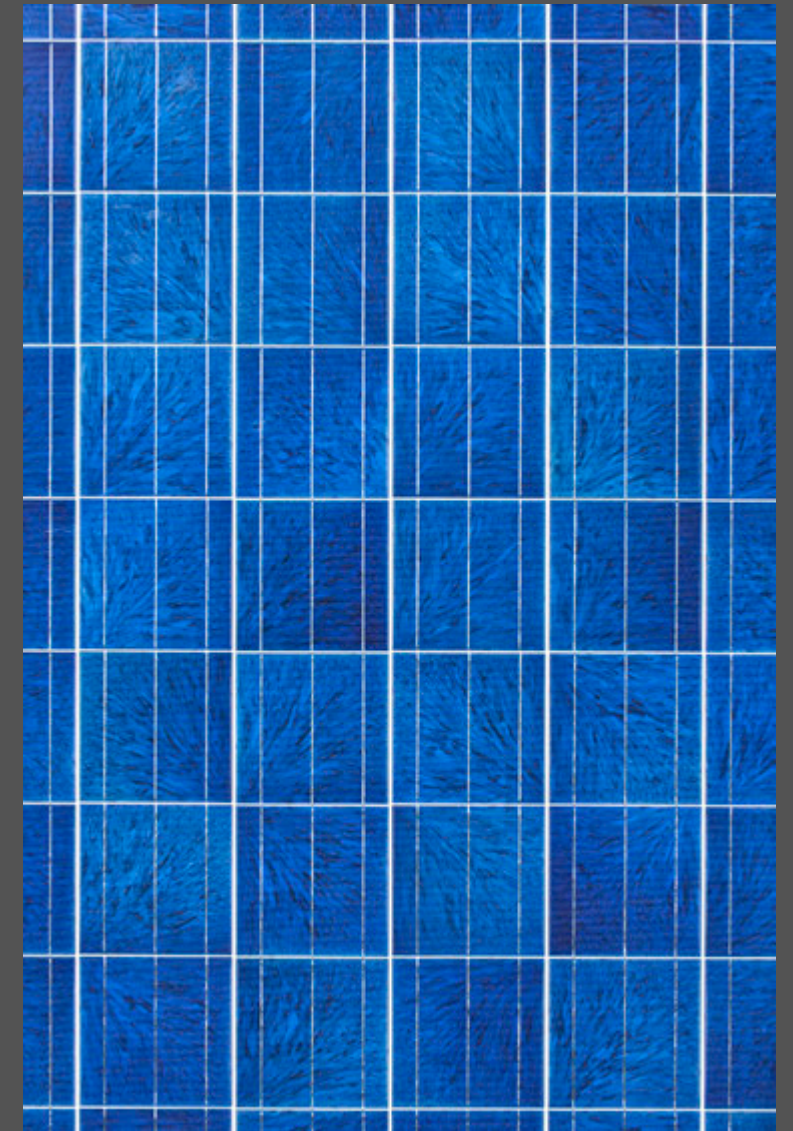
# TYPES OF SOLAR PV PANELS



mono-crystalline



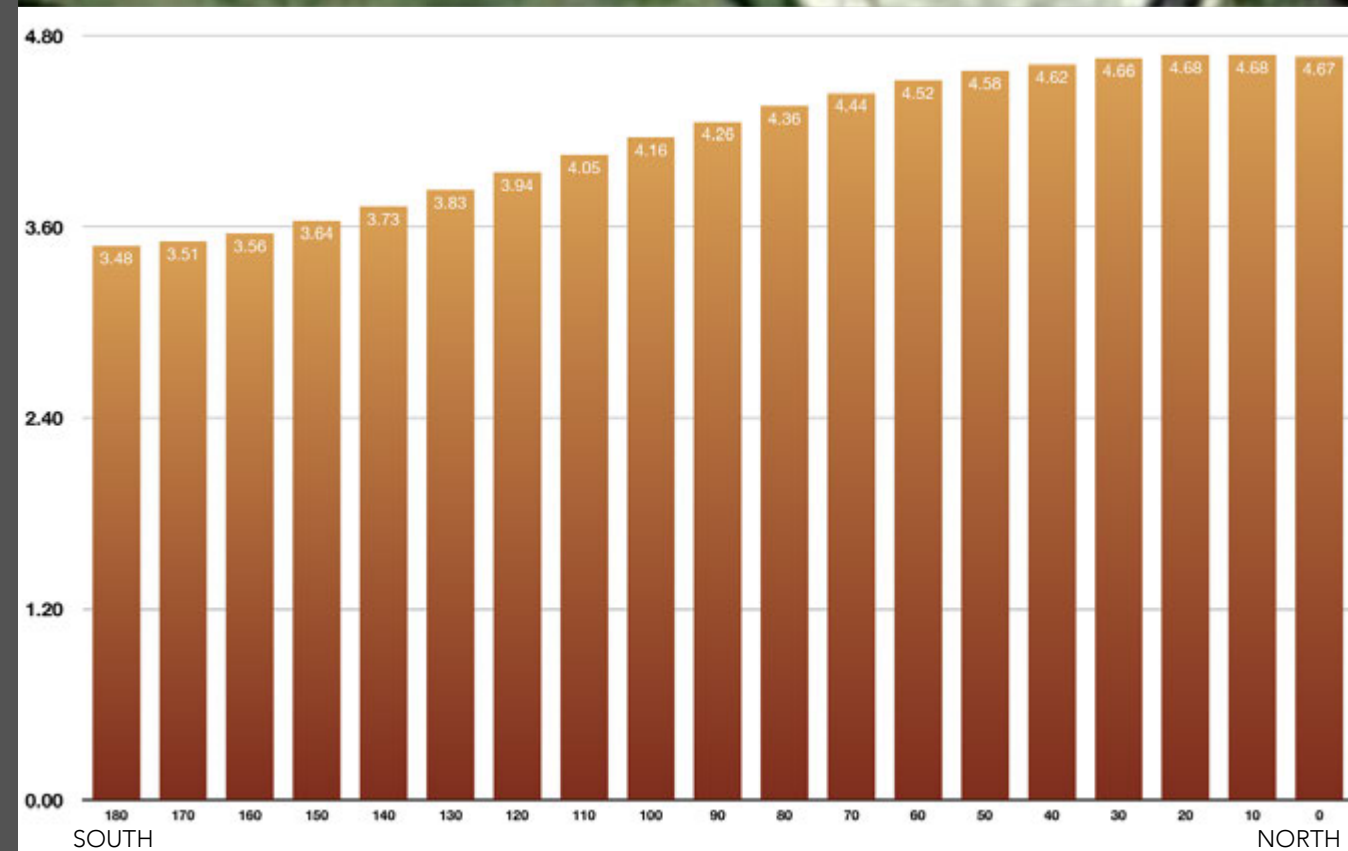
thin film pv



polycrystalline

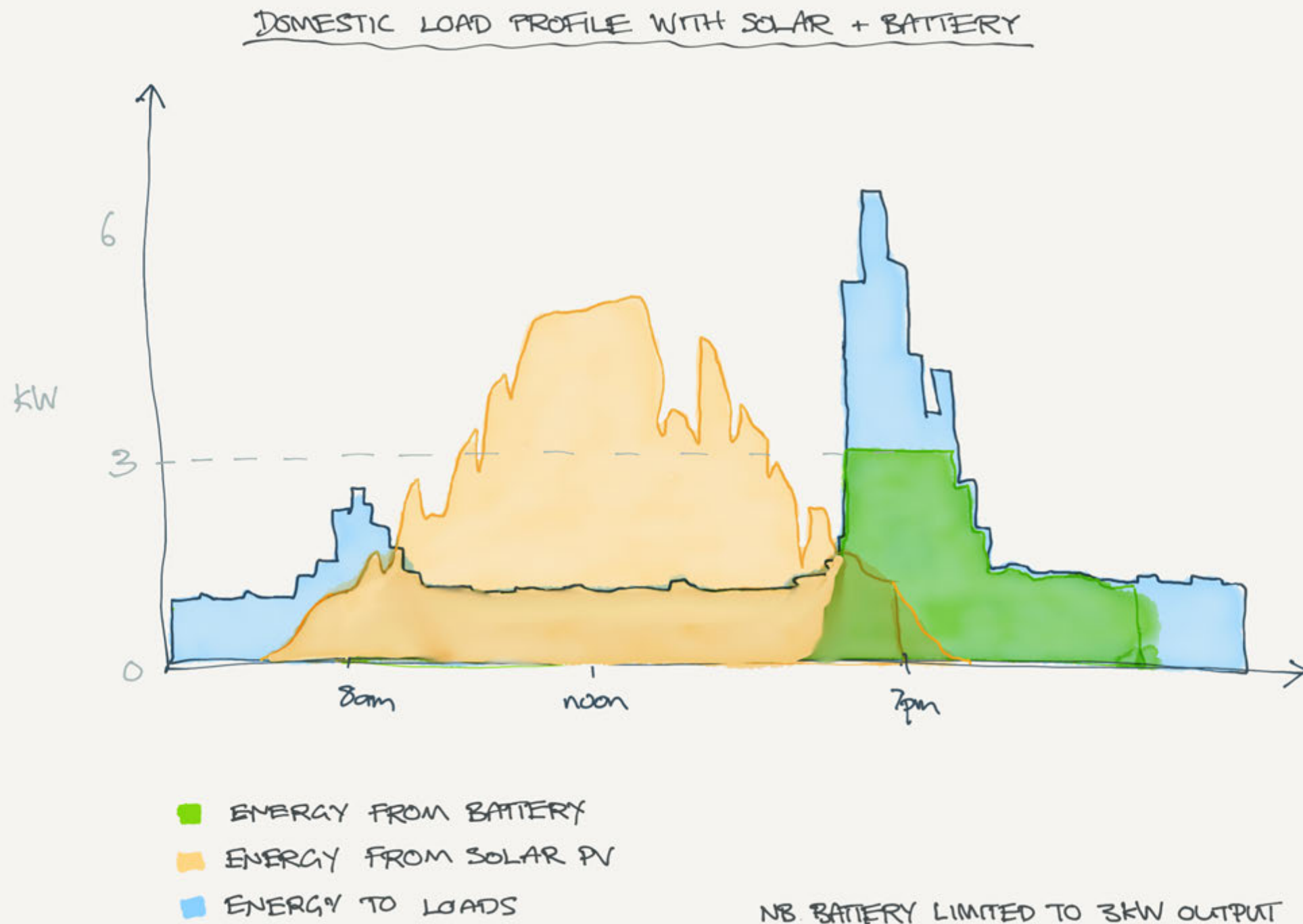
# IS MY ROOF SUITABLE FOR SOLAR POWER?

- Annual average peak sun hours for Melbourne
- North 4.67 PSH  
(30 degree inclined roof)
- South 3.48 PSH  
(30 degree inclined roof)
- south facing is 75% as good as north





# SELF-USE OF SOLAR IS BEST





# Moss House - SMA + 3 Phase Meters



Portfolios > Smart Energy Lab > Moss House - SMA + 3 Phase Meters

Overview Performance Live Devices Settings Users Alerts

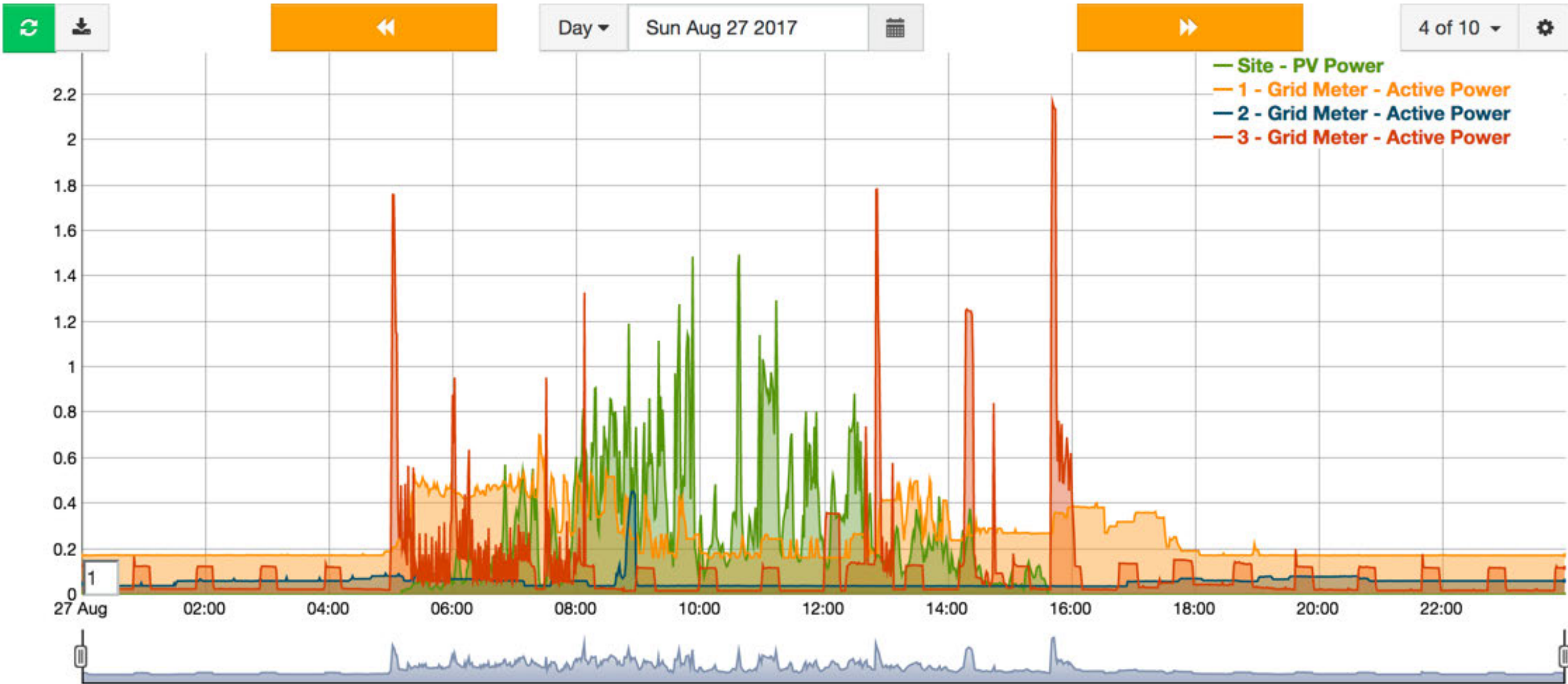
1.413 kWh  
TOTAL ENERGY



0.000 kW  
CURRENT POWER



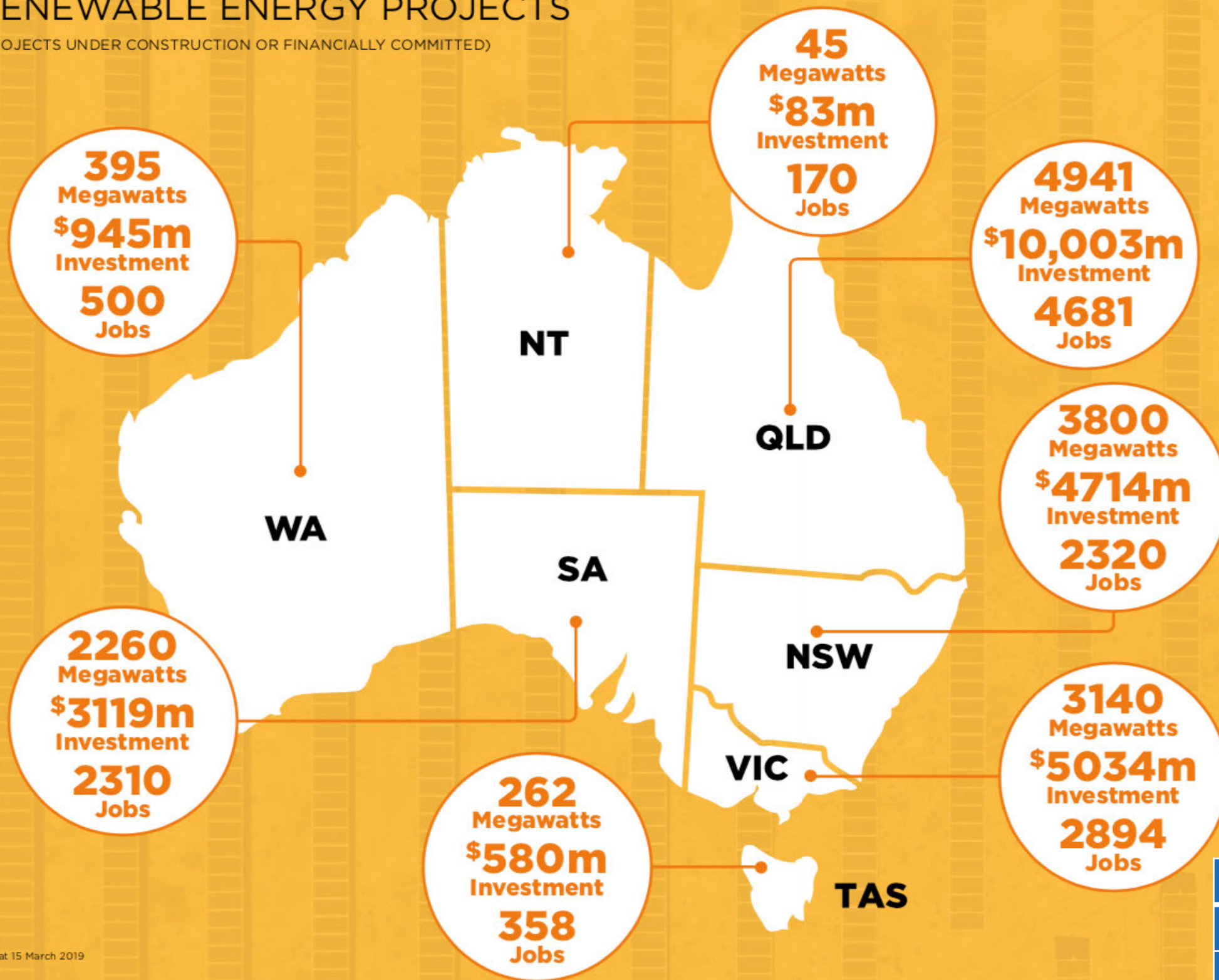
1.497 kW  
PEAK POWER





# THE CONSTRUCTION BOOM FOR LARGE-SCALE RENEWABLE ENERGY PROJECTS

(PROJECTS UNDER CONSTRUCTION OR FINANCIALLY COMMITTED)



## TOTALS

14,841  
Megawatts

\$24.5b  
Investment

13,233  
Jobs

Loy Yang A	2200 MW
Loy Yang B	1050 MW
Yallourn	1480 MW

\* As at 15 March 2019



# SOLAR VICTORIA REBATES



**Solar Panel rebate**



**Solar Hot Water rebate**



**Solar battery rebate**



**Solar for Renters**



<https://www.solar.vic.gov.au/>



## Solar Panels (PV) Rebate

We are making solar panels more affordable than ever before.

The package will provide a rebate on the cost of a solar PV system, up to a maximum of \$2,225.



Rebate\* up to a  
**maximum of \$2,225**



Typical households can **save**  
**\$890 per year on their bills**

The rebate applies to all solar PV systems that meet [safety and quality standards](#) and that were installed on/or after 19 August 2018.

Solar power is safe and reliable and by generating your own solar power, you'll be reducing your electricity bills.

Households can only access **one** rebate type under the solar homes package (i.e. a household that accesses a Solar PV rebate cannot claim a solar hot water rebate and vice versa).

### Important note:

\*The timings below are indicative only and based on all the correct paperwork being included at the time the application was submitted.

Missing documents and incomplete information will result in processing times taking longer than usual.



## Solar Hot Water Rebate

We provide a rebate of up to \$1,000 on solar hot water systems. This is a great option for households where solar panels might not be suitable, or for households that already have solar panels installed.



**Rebate\* up to \$1,000**  
on solar hot water systems



Typical households can **save**  
**\$160-400 per year on their bills**

## Solar hot water rebates are now open

The solar hot water rebate applies to installations that replace an existing hot water system that was at least three years old (from the date of purchase) and it's not available to new build homes (new Class 1 buildings).

Households can only access **one** rebate type under the solar homes package (i.e. a household that accesses a Solar PV rebate cannot claim a solar hot water rebate and vice versa).

### Important note:

\*The timings below are indicative only and based on all the correct paperwork being included at the time the application was submitted. Missing documents and incomplete information will result in processing times taking longer than usual.



# BATTERY REBATES

- From 1 July 2019, the Solar Homes program will introduce rebates for up to half the value of the installation of a battery storage unit for 10,000 households that already have solar panels installed.
- Eligible homeowners will be able to save up to \$4,838 on this installation.
- Victorians with a household income of up to \$180,000 who live in their own home valued at up to \$3 million are eligible for these rebates.
- Homeowners will only be eligible for one rebate across the Solar Homes program.





# INTEREST FREE LOANS

- Solar Homes program a loan scheme will commence for solar PV systems for owner-occupiers from July 2019. This will allow Victorians to access the benefits of renewable energy at no up-front cost.
- Eligible households will be able to install solar panels on their home, saving households hundreds of dollars a year on their energy bills.
- Renters will be able to access an interest-free loan for a solar PV system when the renters program commences in mid-2019.
- Households will be required to pay back the amount of the loan over four years, which will assist Victorians with budgeting for their cost of living.
- Households who choose to access the solar PV rebate before the loans scheme opens in July 2019 will not be able to apply for the interest-free loan.





# FEDERAL SOLAR INCENTIVE (STC'S)

- Small Scale Certificates (STC's)
- 1.185 (zone) x kW x 12yrs deeming
- eg. 5kW PV = 71 certificates
- @\$36ea x 71 = \$2,556

The screenshot shows the Australian Government Clean Energy Regulator website. The header includes the Australian Government logo and the 'RENEWABLE ENERGY TARGET' logo. The navigation bar contains links for 'About the Clean Energy Regulator', 'Emissions Reduction Fund', 'National Greenhouse and Energy Reporting', and 'Renewable Energy Target'. The main content area features a breadcrumb trail: 'Clean Energy Regulator > Renewable Energy Target > RET'. A sidebar on the left lists links: 'About the Renewable Energy Target', 'How to participate in the Renewable Energy Target', 'Scheme participants and industry', 'Forms and resources', 'News and updates', 'Subscribe to email updates', and 'Events'. The main content area has a large banner for 'Renewable Energy' with a 'READ MORE' button. Below this is a 'Popular Topics' section with a 'We want to hear from you!' heading and a 'TAKE PART NOW' button. A list of topics includes 'Small-scale Renewable Energy Scheme', 'Small-scale technology certificates', 'Small-scale systems eligible for certificates', and 'Postcode data for small-scale installations'.

Australian Government  
Clean Energy Regulator

RENEWABLE ENERGY TARGET

About the Clean Energy Regulator | Emissions Reduction Fund | National Greenhouse and Energy Reporting | Renewable Energy Target

Clean Energy Regulator > Renewable Energy Target > RET

About the Renewable Energy Target >

How to participate in the Renewable Energy Target >

Scheme participants and industry >

Forms and resources >

News and updates

Subscribe to email updates

Events

## Renewable Energy

The Renewable Energy Target is an Australian Government initiative to increase the electricity sector and encourage the additional generation of renewable energy.

[READ MORE >](#)

### Popular Topics

We want to hear from you!

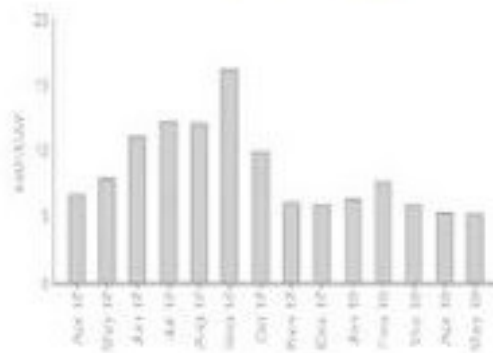
We're improving our online services and systems. Tell us about your experience with the agency by completing this quick survey.

[TAKE PART NOW >](#)

- Small-scale Renewable Energy Scheme
- Small-scale technology certificates
- Small-scale systems eligible for certificates
- Postcode data for small-scale installations



## Your daily usage



### Average use per day

Peak	13.31 kWh
Off Peak	7.39 kWh
Shoulder	3.47 kWh
<b>Daily Average</b>	<b>24.17 kWh</b>
<b>Total</b>	<b>2225 kWh</b>

### Average cost per day (ex GST)

Peak	\$4.45
Off Peak	\$0.99
Shoulder	\$0.89
<b>Total</b>	<b>\$6.33</b>

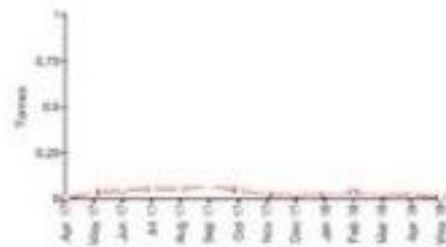
Average daily kWh usage

Total kWh usage

### Average use same time last year

Peak	16.11 kWh
Off Peak	6.37 kWh
Shoulder	6.77 kWh
<b>Daily Average</b>	<b>24.17 kWh</b>

## Greenhouse gas emissions



Total greenhouse gas emissions from this account: 0.02 Tonnes

Tariffs – including usage and charges

Days in billing period

## Your account in detail

Supply address	1234 Main Street, Somewhere Victoria 3123
NMI	123456789
Supply period	12 May 2018 – 11 August 2018 (92 Days)
Plan	DailySaver Tariff

Electricity charges (92 Days)	Rate \$ per KWH	Total \$
Peak 1225 kWh	\$0.3345	\$409.76
Off peak 680 kWh	\$0.1350	\$91.80
Shoulder 320 kWh	\$0.2565	\$82.08
Service to property charge – 92 days	\$0.7193	\$66.17
<b>Total electricity charges (Ex. GST)</b>		<b>\$649.81</b>
<b>Total electricity charges (Inc. GST)</b>		<b>\$714.79</b>
Vic Solar Feed in Tariff (8.25 kWh/day)	\$0.156	\$118.40 CR

**COMPARE**

Your Energy  
Retailer

Customer account number: 8593 1234

**Total (Inc. GST): \$596.39**

Bill Issued:

14 August 2018

Payable by:

25 September 2018



# COMMON TERMS

- **Average cost per day:** This is how much you pay each day on average for energy for this billing period.
- **Average daily usage:** This is how much energy you use each day on average. It is measured in kilowatt hours (kWh) for electricity and megajoules (MJ) for gas.
- **kWh:** Electricity energy consumption is measured in kilowatt hours. A kilowatt (kW) is 1000 watts of electrical power. For example, if you run a 1000-watt heater for one hour, it will use 1 kWh.
- **MJ:** Gas energy consumption is measured in megajoules. A megajoule (MJ) is a measure of gas equal to one million joules.
- **Charge/kWh:** Electricity usage is priced in cents per kilowatt hour, for example, 22.56 cents per kilowatt-hour (c/kWh). So if you use 20 kWh each day, it would cost \$4.51 each day.
- **Peak, off-peak and shoulder:** If you choose a flexible pricing or time-of-use electricity plan, there will be different charges for energy use during peak, off-peak and shoulder periods.
- **Service to Property:** A fixed charge that is also called the 'daily supply charge'.

# TARIFF OPTIONS

- **Flat rate:** This is the most common type. The same rate is charged for electricity consumed at any time of the day or night.
- **Time-of-use:** This is where a different price is charged according to when the electricity is used during the day.
- Time-of-use tariffs usually involve peak and off-peak pricing, which means users are charged less for electricity during 'off-peak' or low demand periods and a higher rate for electricity used during high demand or 'peak' hours.
- You may not be eligible for time-of-use offers so check with your retailer.
- **Flexible pricing:** This is an extended 'time-of-use' tariff, with peak, shoulder and off-peak rates. New flexible pricing plans have some consumer-protections associated with them, unlike the older and still available 'time-of-use' plans.



# SOLAR INVERTERS

- convert solar dc electricity into grid-connected ac electricity
- optimise the operation of your solar panels
- may be installed inside or outdoors
- need adequate ventilation
- should be inspected for alarms and faults regularly



# Battery inverters and solar inverters



Battery Inverter



Solar Inverter

SMA Sunny Island & Sunny Boy



# Hybrid inverters (solar + battery)



SolaX

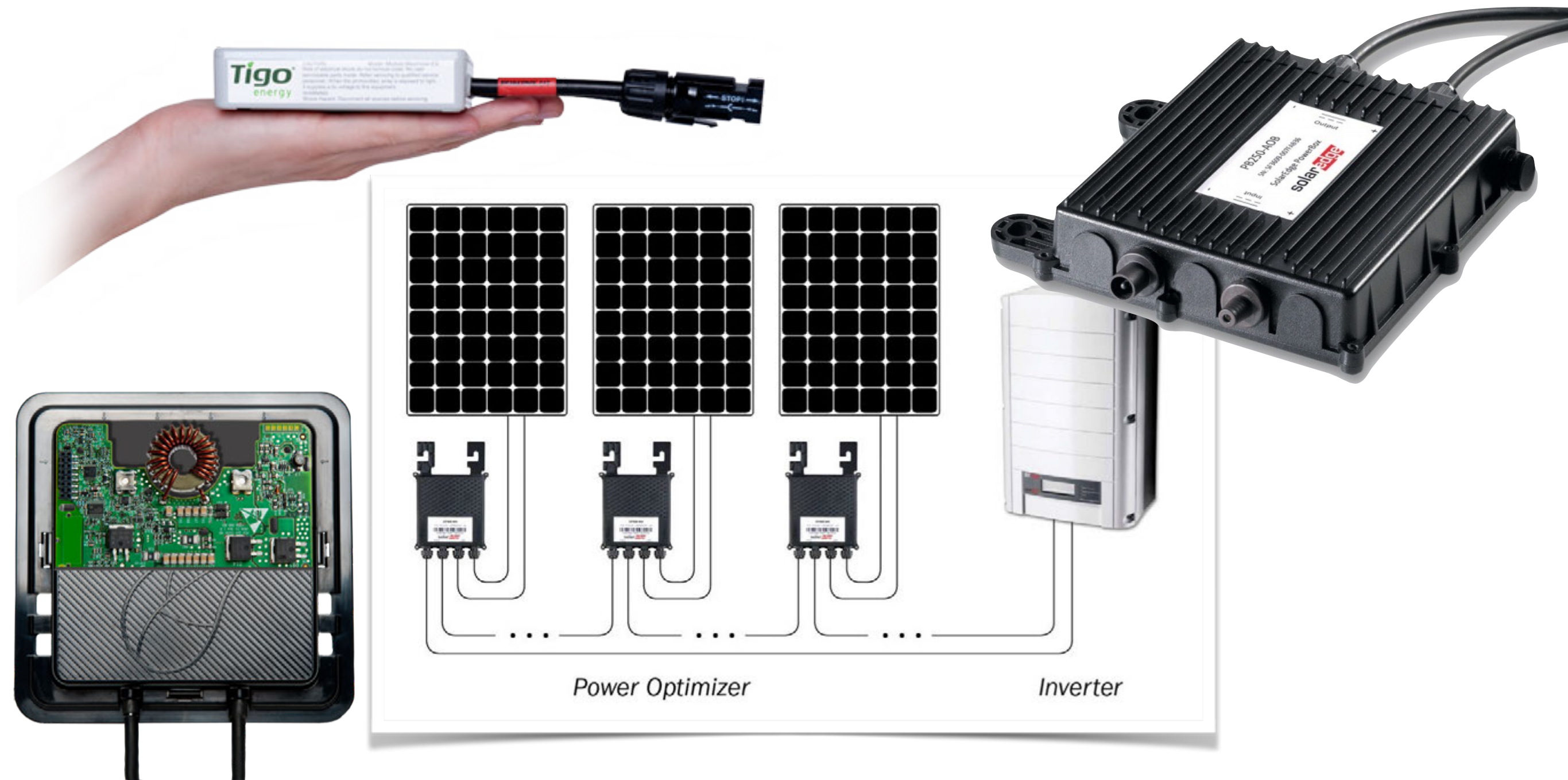


Huawei

# “AC” batteries







# solar panel optimisers

NOT micro inverters - allow each panel to work independently



Dashboard



Layout



Charts



Reports



Alerts



Admin

Choose a site (insert at least 3 letters to search):

Boat Shed South

> Show tree

> Show playback

Yearly ▾

Physical layout ▾



65.97 kWh	67.79 kWh	62.77 kWh	54.57 kWh	69 kWh	70.58 kWh	71.3 kWh	70.38 kWh	71.56 kWh	71.73 kWh	72.41 kWh	72.29 kWh	72.39 kWh	70.74 kWh	71.41 kWh
1.1.1	1.1.2	1.1.3	1.1.4	1.1.5	1.1.6	1.1.7	1.1.8	1.1.9	1.1.10	1.1.11	1.1.12	1.1.13	1.1.14	1.1.15



1.08  
MWh

1







# Micro Inverters

tiny inverters beneath each solar panel

# BATTERIES

- store energy for later use
- allow self-use of solar energy at night
- may provide limited backup power during grid outage
- many technologies, location and safety need to be considered



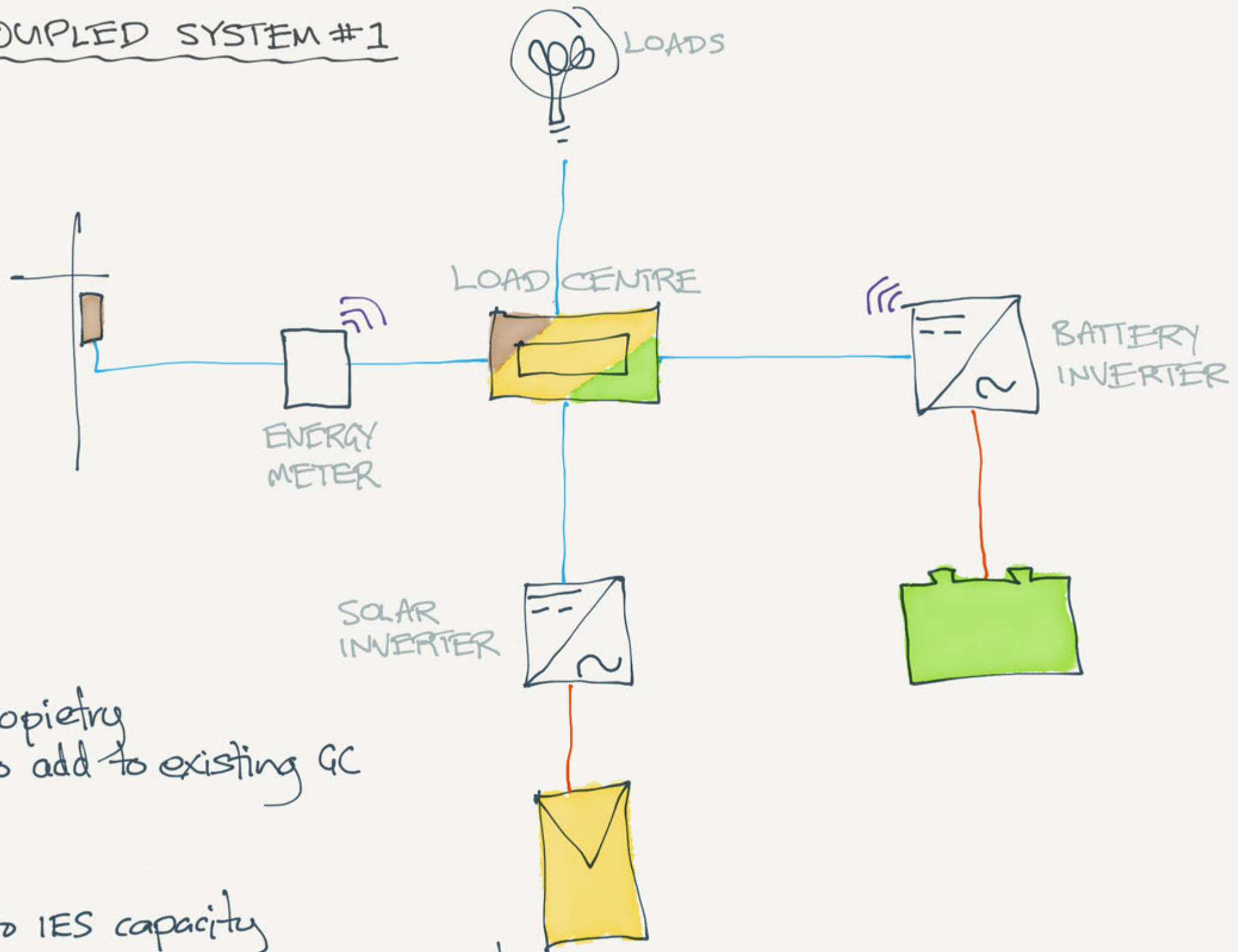


# CAN BATTERIES BE RETROFITTED?

- easily if “ac coupled” (eg. Tesla/Sonnen/VARTA/Enphase)
- add parallel hybrid system with more solar and battery
- may be restricted by electricity supply authority limits (eg. 5kW maximum total inverter capacity)
- 3 phase installations have higher limits but require “phase balancing” of multiple inverters



## AC COUPLED SYSTEM #1



### PROS:

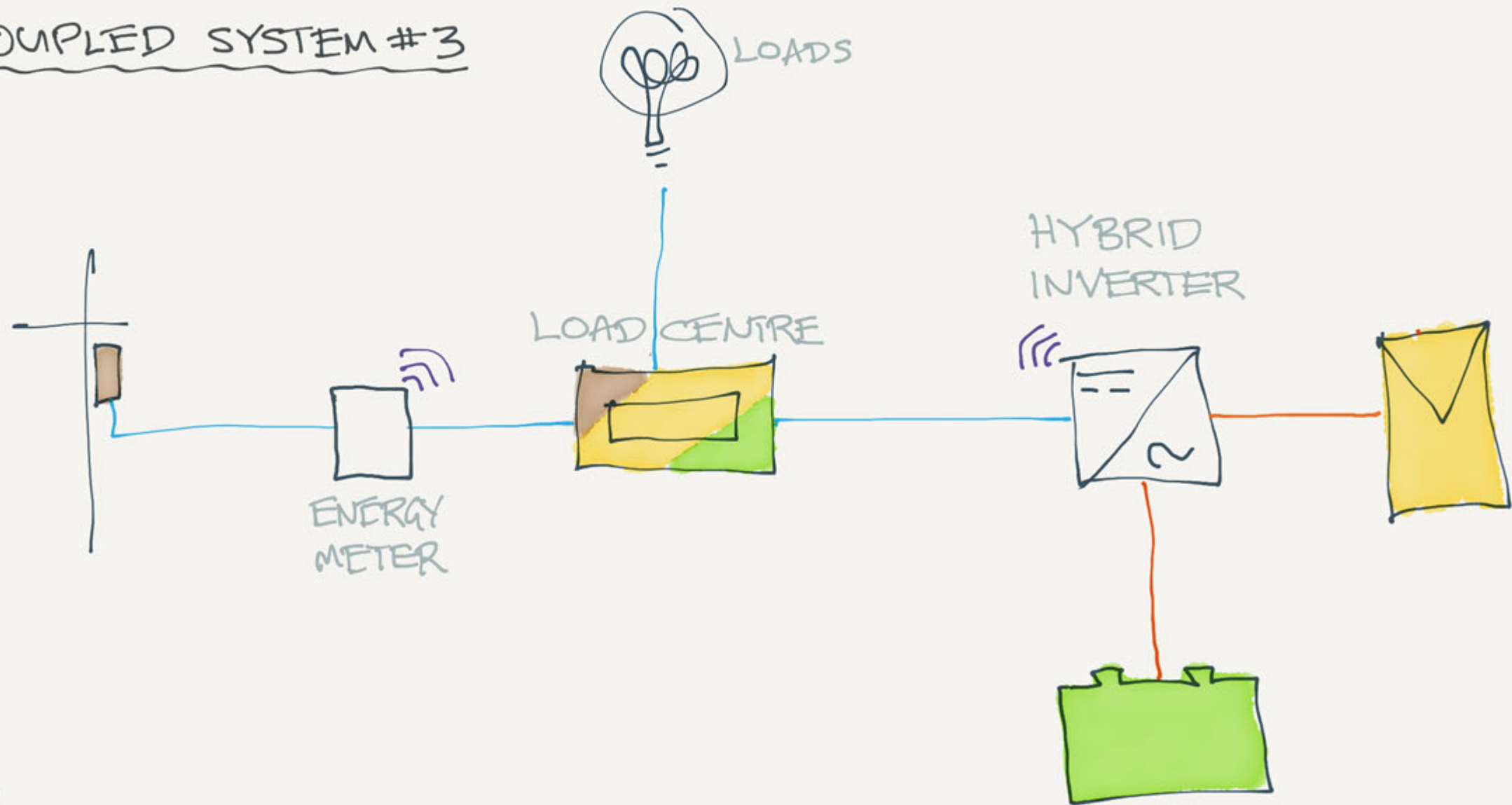
non-proprietary  
easy to add to existing GC

### CONS:

adds to IES capacity  
solar only works when grid present  
possibly no backup



### DC COUPLED SYSTEM #3



#### PROS:

simple all-in-one  
may charge battery without grid

#### CONS:

requires energy meter for self-consumption of solar  
only supplies loads when grid present (no backup)

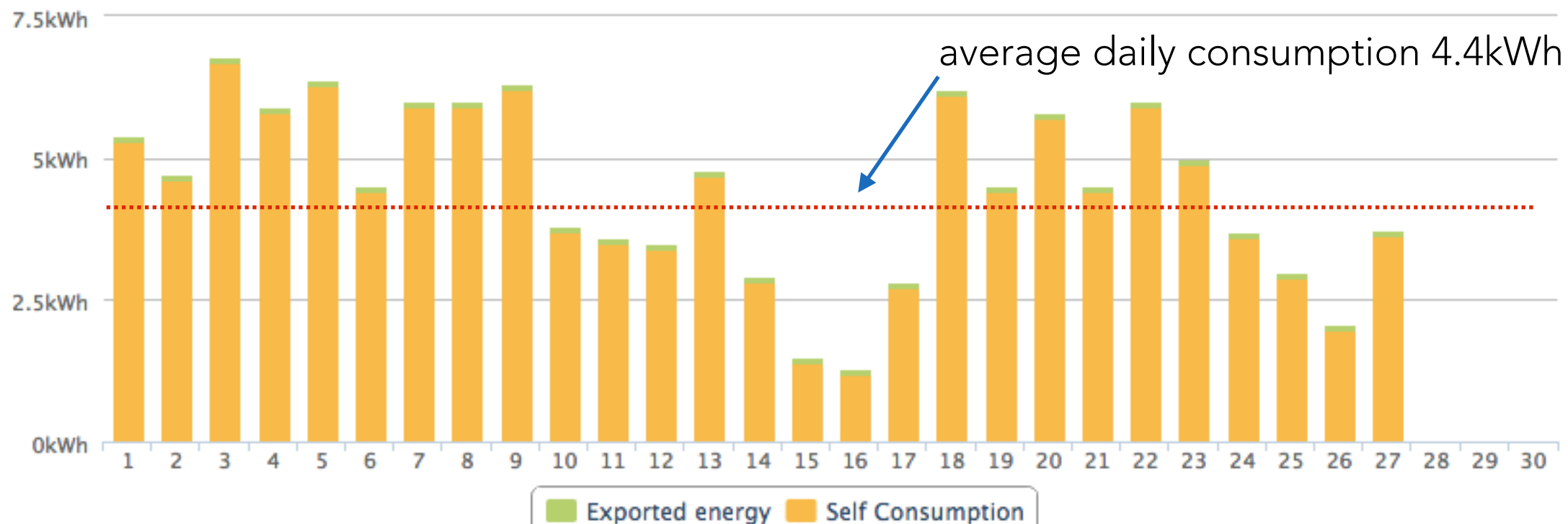
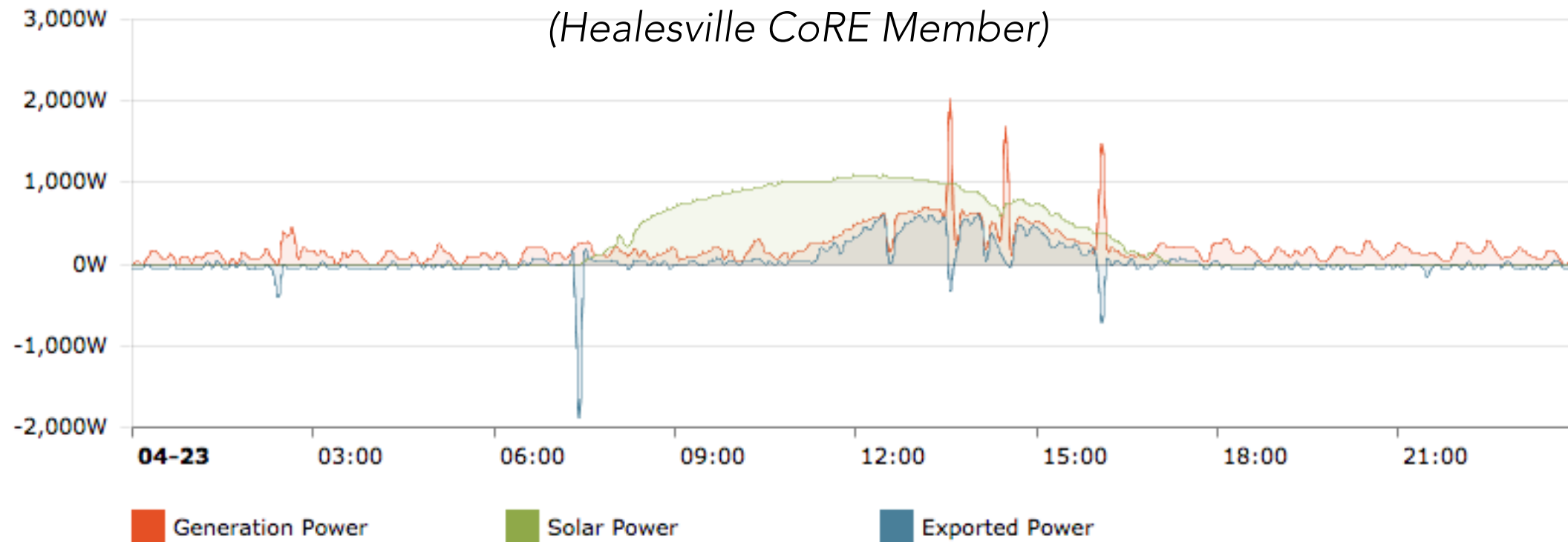
# MONITORING & CONTROL

- help users measure their energy usage
- can automatically detect faults
- may allow trading of your energy for higher returns
- may allow remote access and control of loads (eg. hot water/air con)





(Healesville CoRE Member)



# ECONOMIC ANALYSIS



Healesville VIC 37°

Set Location

-37.657

145.532000

Set Coordina



NORTH



Scale: 150%



+

-

Advanced Map Edit



in meters

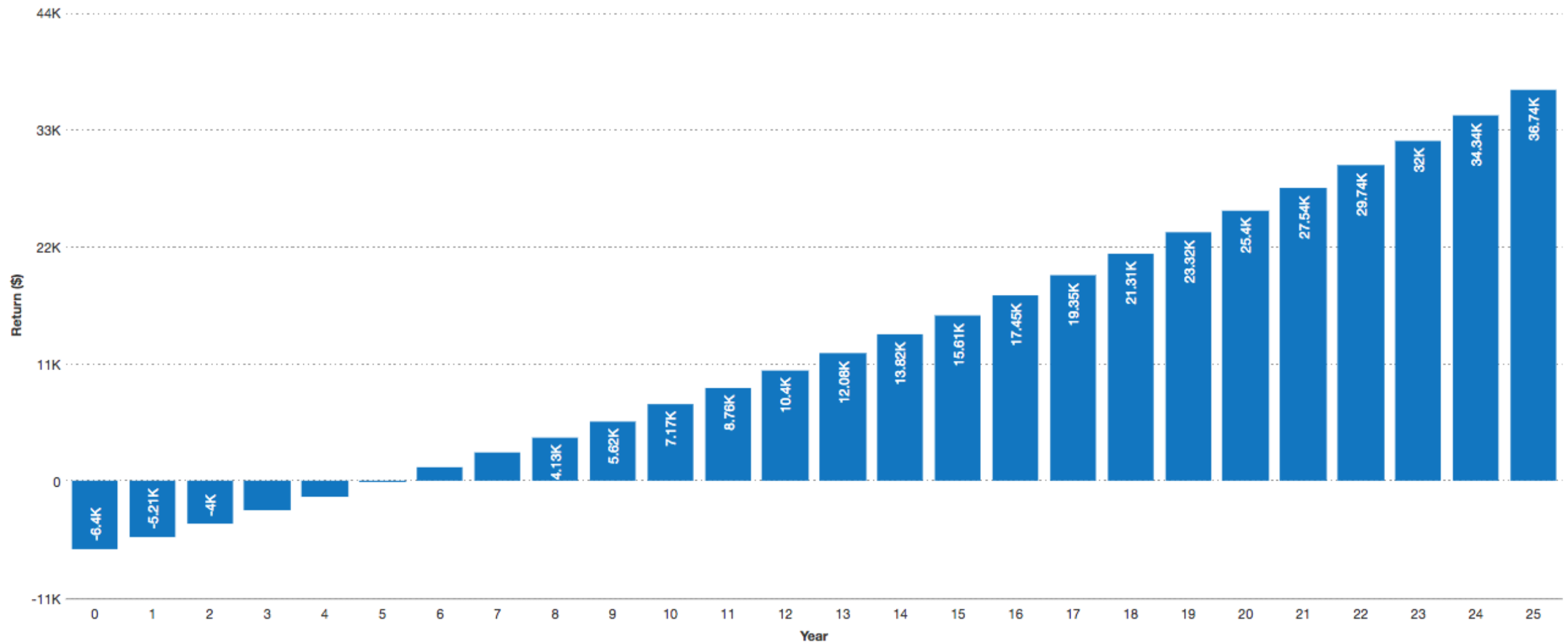




# 5kW PV system (no battery)

east/west array, no aircon

## Lifetime cashflow



### YEAR ONE CASHFLOW

**Investment:** \$6,397.90  
**\$/watt:** \$1.28  
**Est. Yr 1 savings:** \$1,183.32 (42%)

### RETURN METRICS

**Payback time:** 5 yrs 1 mths  
**Internal rate of return:** 18.1%  
**Levelised cost of energy:** 4.93 c/kWh

### LIFETIME METRICS

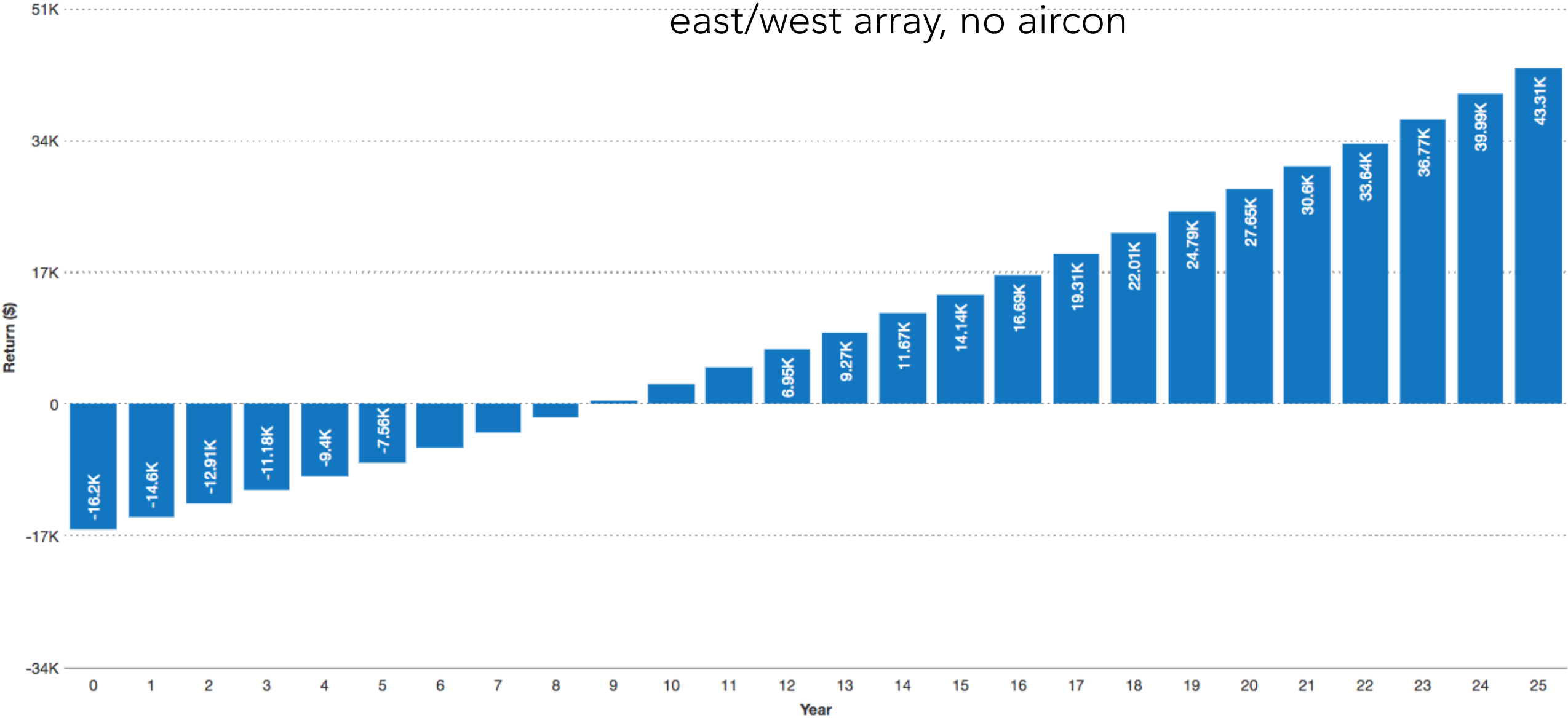
**Est. lifetime savings:** \$36,745.20  
**Net present value:** \$21,174.68  
**CO<sup>2</sup> savings:** 6,435 kg CO<sup>2</sup>e. p.a.

Median price for 5kW PV system in Melbourne ([ata.org.au](https://ata.org.au))



# 5kW PV system (Tesla PW2 battery)

east/west array, no aircon



## YEAR ONE CASHFLOW

Investment:	\$16,230.40
\$/watt:	\$3.25
Est. Yr 1 savings:	\$1,633.06 (58%)

## RETURN METRICS

Payback time:	8 yrs 10 mths
Internal rate of return:	10.4%
Levelised cost of energy:	12.49 c/kWh

## LIFETIME METRICS

Est. lifetime savings:	\$43,309.65
Net present value:	\$21,821.41
CO <sup>2</sup> savings:	6,435 kg CO <sup>2</sup> e. p.a.

Typical pricing for 5kW PV system with Tesla Powerwall 2 battery

# MULTIPLE SOLAR PV SYSTEMS

- PV water heating
- Solar thermal water heating
- Solar PV power to home (can be used to run heat pump)
- Surplus solar PV can be “diverted” to hot water tank





# My Home – Moora Moora Coop

45 YEARS WITHOUT MAINS POWER

